

**SANDING APPARATUS FOR A SANDING MACHINE**

The invention relates to a sanding device for a sanding machine, comprising a carrier, a sanding element and at least two coupling elements with which the sanding element is coupled to the carrier, wherein a 5 movable connection is provided between the sanding element and the carrier.

Such a sanding device is known from WO 96/34721. In this known sanding device a sanding element is connected via two pivot arms to a carrier which is 10 releasably connected to the sanding sole of a sanding machine. The sanding element consists of a flexible support plate with pads to which a piece of sandpaper is fixed. On one side the pivot arms are mounted pivotally on the support plate and on the other arranged slidably 15 in slotted holes in the carrier. The ends of the pivot arms can be fixed in the slotted holes via nuts. For sanding purposes the curvature of the support plate is adjusted as desired by sliding the pivot arm ends in the slotted holes and fixed in place by tightening the nuts. 20 The sanding element thus has a fixed position during sanding.

A drawback of this known sanding device is that it is a relatively complex construction, while the degree of flexibility is very limited, particularly 25 during sanding of surfaces with a radius of curvature.

The present invention has for its object to provide such a sanding device, the construction of which is simpler and more suitable for sanding surfaces with different radii of curvature.

This object is achieved in that the ends of the coupling elements coupled to the sanding element can move relative to each other during sanding.

The coupling elements only support the sanding  
5 element at the ends. In the centre of the sanding element the sanding element is not supported, so that it is sufficiently flexible. Because these ends of the coupling elements can move relative to each other, the radius of curvature on the surface for sanding can be  
10 adjusted during sanding.

The coupling elements can themselves be flexible here in order to provide the desired movement. It is however also possible for the coupling elements to be hingedly connected to the carrier. Both variants can  
15 also be combined.

According to one embodiment, the device comprises means for urging the coupling elements apart at least at the position of the sanding element. An additional tensioning force is hereby generated in the  
20 sanding element, whereby the normal force to be exerted by the sanding element, and thereby the sanding force, is greater.

Since it is expected that in practice such a sanding device will usually be used to sand round  
25 surfaces such as pipes, it is attractive when the sanding surface can curve in accordance with a cylinder, this being facilitated by the measure that the sanding element is connected to two coupling elements and that the connecting lines between the coupling elements on  
30 the one hand and the sanding element on the other extend substantially parallel.

Another embodiment provides the measure that the sanding element comprises a flexible supporting element connected fixedly to the coupling elements, for  
35 the purpose of supporting a sheet of sandpaper for

connecting thereto. The supporting element connected fixedly to the coupling elements is for instance formed by a piece of fabric or other flexible material, which is preferably provided with Velcro material for  
5 attaching a sheet of sandpaper or sand cloth thereto. This sandpaper or sand cloth must then of course be provided with mating Velcro material. It is otherwise also possible to make use of a supporting element into which the Velcro material is already integrated.

10 A specific embodiment provides the measure that the coupling elements are connected to a base, and that the base is releasably connected to the carrier.

Another embodiment provides the measure that the sanding element has the form of a closed sanding  
15 belt which extends around the combination of coupling elements and base. It hereby becomes possible to make use of annular belts of sanding material, wherein these can be mounted with a simple operation. The use of a support for the sandpaper or sand cloth between the  
20 coupling elements is unnecessary here. Replacement of the sandpaper is moreover easier.

According to a further aspect of the invention, the base is connected releasably and rotatably to the carrier in order to facilitate sanding.  
25 In addition to rotation of the sanding element, this measure provides the option of exchanging the sanding element, together with the base and the coupling elements, for a similar combination with a different configuration or shape. Other processing elements can  
30 moreover be placed, such as a rigid sanding element or an element adapted to carry out a process other than sanding.

In addition, the base can be releasable in at least one angular position of the carrier. Use is for  
35 instance made here of a configuration of a bayonet

fitting, wherein the fitting is in the locked position in an active position of the sanding element.

Other attractive preferred embodiments are stated in the remaining claims.

5       The invention further relates to a sanding machine comprising a sanding sole and a sanding device, wherein the carrier of the sanding device can be formed by the sanding sole of the sanding machine or the sanding device can be releasably connected to the  
10 sanding sole of the sanding machine.

The present invention will be elucidated hereinbelow with reference to the annexed drawings, in which:

15       Figure 1 is a schematic perspective view of a first embodiment of a sanding machine according to the invention;

Figure 2 is a detail view with exploded parts of a part of the sanding machine shown in figure 1;

20       Figure 3 is a schematic perspective view of a second embodiment of the sanding machine;

Figure 4 is a detail view with exploded parts of a part of the sanding machine shown in figure 3;

25       Figure 5 is a schematic perspective view of a further embodiment of a sanding device according to the invention;

Figure 6 is a schematic perspective view of a further embodiment of a sanding device according to the invention;

30       Figure 7 is a schematic perspective view of a final embodiment of a sanding device according to the invention, wherein a part is removed;

Figure 8 is a view corresponding with figure 7, with all parts shown;

35       Figure 9 is a side view of the releasable part of the sanding device shown in figures 7 and 8;

Figure 10 is a perspective top view of the releasable part of the sanding device shown in figures 7 and 8; and

Figures 11A-G show different variants of  
5 sanding elements which are connected releasably and rotatably to a carrier.

Figure 1 shows a sanding machine designated as a whole with 1, which is provided with a sanding sole 2. In the manner of a prior art sanding machine, this  
10 sanding sole 2 can be provided with a piece of sandpaper or sand cloth for performing a surface sanding operation. Sanding machine 1 is herein adapted to drive sanding sole 2 such that it executes a reciprocal movement. This can be a movement back and forth but may  
15 also be a rotating movement, or a combination of both types of movement.

A carrier 3 is fixed onto sanding sole 2. This carrier 3 is connected to sanding sole 2 for instance by means of a snap connection or as according to the method  
20 described in EP-A-1166963.

In addition to carrier 3, the sanding device for sanding machine 1 shown in figures 1 and 2 comprises a sanding element 9, 10 and two coupling elements 8 with which sanding element 9, 10 is coupled to carrier 3.

Carrier 3 is provided with two hinge constructions 4 extending in parallel as shown in figure 2. Each of these hinge constructions 4 is formed by a retaining element 5, which is formed integrally with carrier 3 and a shaft 6. Shaft 6 is provided with  
25 protruding end parts 7 which can be received by means of a snap connection in recesses 29 arranged in retaining elements 5. Hinges 6 are formed integrally with coupling elements 8.

The two coupling elements 8 are coupled to a  
35 sandpaper supporting element 9 manufactured from

flexible material. This sandpaper supporting element 9 is connected for this purpose to coupling elements 8 by means of for instance glueing or another type of connection. On its outside the sandpaper supporting element 9 is provided with Velcro material. Sandpaper 10 can be arranged on the sandpaper supporting element 9 by means of a Velcro connection.

As can be seen in figure 1, it is possible to sand a curved surface, for instance a pipe 11, using the thus formed sanding device.

The majority of the workpieces to be sanded by such a sanding machine 1 have a cylindrical surface. It is therefore attractive, as in the above elucidated embodiment, for hinges 4 to extend parallel to each other. Sanding element 9, 10 will take on the form of the sanding surface as a result of the movable connection between sanding element 9, 10 and carrier 3, in that the ends of coupling elements 8 coupled to sanding element 9, 10 can move relative to each other. The flexibility of supporting element 9 and sanding machine 10 also contribute hereto.

Although this will occur less frequently in practice, it is in principle also possible to sand non-cylindrical objects with such a sanding device. It is possible to consider having the hinges 6 extend at a certain angle for this purpose.

Figures 3 and 4 show another embodiment of the invention, which relates principally to the manner in which the sandpaper is attached.

In the embodiment shown in figures 3 and 4 use is made of an annular piece of sandpaper 12 which is placed round a combination 13. This combination 13 is formed by a base 14 to which two coupling elements 16 are connected by means of hinges 15. The dimensions of the annular piece of sandpaper 12 and combination 13 are

such that, in the situation shown in figure 4, sandpaper 12 is as flat as possible at the position of the sanding surface. In this situation the combination 13 with sandpaper 12 arranged thereon is pushed into a clip 17  
5 arranged on carrier 3. Clip 17 fixedly clamps the combination with the sandpaper 12 arranged therearound.

As a result of the fact that combination 13 is integrally formed, coupling elements 16 will have a preferred position. They will be urged into this  
10 preferred position. A stretching force is hereby exerted on the part of sanding belt 12 adapted for the sanding operation. In the foregoing embodiment there is no such preferred position. This can of course be arranged as desired. The relevant means can be provided for this  
15 purpose.

An advantage of the embodiment shown in figure 4 is that sandpaper 12 can be used more completely. After the uppermost piece of sandpaper 12 has been used,  
20 the annular sandpaper 12 can be rotated and a subsequent piece of sandpaper 12 can be used.

The embodiment shown in figure 5 comprises a carrier 3 in the form of a sanding sole for releasable connection to a sanding machine, on which sole a base 14 is rotatably mounted. On base 14 are arranged two  
25 coupling elements 16 which are manufactured from flexible material. At least the distal ends of these coupling elements 16 are connected to a sanding element (not shown). In this embodiment the coupling elements 16 and base 14 are embodied integrally.

30 Base 14 is provided with a shaft which is not shown in the drawing and which extends into carrier 3 perpendicularly of carrier 3. Base 14 is provided with a nose which is not shown in the drawing and which engages under a substantially L-shaped edge 18 fixed to carrier  
35 3. This edge 18 extends in a circular arc.

Base 14 is secured on carrier 3 in that the nose protrudes below L-shaped edge 18. Base 14 can be removed by rotating the nose from under edge 18. Base 14 can be locked on carrier 3 in diverse angular positions 5 by per se known locking means, such as an elevation 25 as shown in figure 5 in co-action with a corresponding recess in the bottom of base 14. The action of a bayonet fitting is obtained here.

Rapid exchange of the base 14 with the sanding 10 element arranged thereon is thus possible, wherein a good connection to base 14 is obtained despite this advantage, this being important in respect of the transfer of forces during sanding. This fastening otherwise provides the option of rapid replacement of 15 base 14 by a base on which is placed a sanding element with a different configuration. As well as a flexible sanding element, it is thus possible for instance to apply a substantially rigid sanding element with a form adapted to the operation to be performed, such as a 20 concave, convex, folded form or with a sharp point.

The advantages obtained with the above discussed embodiment can however also be obtained with the embodiment according to figure 6.

In the embodiment of figure 6 the reference 25 numeral 3 designates the sanding sole of the sanding machine (not further shown) since this fulfills the function of carrier 3. A clamping element 20 is connected rotatably to sanding sole 3. Clamping element 20 is mounted for this purpose on carrier 3 by means of 30 a shaft 21. The clamping element is provided with a U-shaped end part 22 and a pair of ridges 23. Ridges 23 continue as side walls 27 and 28, of which the wall 28 is shown broken-away in figure 6.

A base 14, on which a sanding element can be 35 mounted via coupling elements or an element for

performing another type of process can be directly mounted, is provided with two noses 24, 26. In the position of clamping element 20 shown in figure 6, the first nose 24 can be pushed into U-shaped end part 22  
5 and the second nose 26 can be placed between ridges 23. The thus obtained assembly can then be rotated until the second nose 26 comes to lie under retaining edge 18 and is secured thereby.

Figure 7 shows a further embodiment of a  
10 sanding device according to the present invention. Use is once again made here of a carrier 3, on which is arranged a bearing 30. Bearing 30 is semicircular. An L-shaped edge 18 is further placed on carrier 3, as in the foregoing embodiment. Recesses 31 are arranged in the  
15 upper side of the L-shaped edge.

In the present embodiment the base 14 takes the form of a flat plate 32 which is provided at one end with a disc-shaped part 33. This disc-shaped part 33 fits into bearing 30. The other end 41 of plate 32  
20 extends under the L-shaped profile 18. A connecting piece 34 is arranged on plate 32.

The construction of the assembly described up to this point is such that from a separate position the base 14 can first be placed with its disc 33 into bearing 30 and can then be rotated in the bearing until distal end 41 of plate 32 is situated under L-shaped profile 18 and is retained there. A situation obtained  
25 in this manner is shown in figure 7.

Three recesses 31 are arranged in the upper side of L-shaped edge 18 in order to fix base 14 in one of three possible positions. Arranged on connecting part 34 is a tongue 35 which is provided on its front bottom side with a protrusion 36 which fits into each of the recesses 31. For this purpose tongue 35 has a resilient  
35 form, so that protrusion 36 can be placed into any of

the recesses 31. The distal end of tongue 35 can be moved upward again using the fingers, so that protrusion 36 is lifted out of recess 31 and base 14 can be rotated.

5 As is apparent from figure 8, a sandpaper carrier 38 is arranged on connecting part 34. This can be placed releasably on connecting part 34 but can also be arranged fixedly. Sandpaper is attached to sandpaper carrier 38. Sandpaper carrier 38 can be a rigid element  
10 but may also be manufactured from flexible material so that the outer edges thereof can move relative to each other during sanding, and the curvature of sandpaper carrier 38, including the sandpaper, adapts to the workpiece for sanding.

15 It is further pointed out that sandpaper carrier 38 is placed obliquely relative to carrier 3. This means that the distance between carrier 3 and sandpaper carrier 38 is greater in the vicinity of tongue 35 than in the vicinity of bearing 30. In other  
20 words, the lower and upper edge of connecting part 34 do not extend parallel to each other (see figure 9). This measure has been taken to enable better execution of determined sanding operations. Sanding machine 1 can then be handled more easily while maintaining full  
25 contact between sandpaper carrier 38 and the workpiece.

Figure 9 further shows the separate part of the sanding device, i.e. the combination of sandpaper carrier 38 and base 32, 34 on which it is mounted.

Figure 10 finally shows the component of  
30 figure 9 from above. Here is shown that on the distal end 41 of plate 32 a chamfering 39 is arranged for easy movement of plate 32 to a position under the L-shaped edge 18. Slots 40 are further arranged in order to form resilient tongues enabling practically immobile placing  
35 of plate 32 under edge 18.

It will be apparent that base 32, 34 can be readily exchanged for a base on which a different sanding element or a different processing element is placed. Different variants are shown in figures 11A-G.

- 5 Shown successively are a rigid sanding element of square (fig. 11A), V-shaped (fig. 11B), triangular (fig. 11C), finger-like (fig. 11D), concave (fig. 11E) and convex (fig. 11F) form and a flexible sanding element according to the embodiment of figures 1 and 2 (fig. 11G).

10 It will be apparent that numerous variations can be made to the embodiments shown here.